[Effect of the invention]

As described above, according to claim 1 of the present invention, the plurality of ribs on the cover are crushed at the time of a vehicle collision, so that an impact is absorbed, and the breakage of the cover except the ribs is prevented. Therefore, the electrodes of the batteries, the bus bars, the terminals and so on within the cover are protected from the external force or impact. Particularly, the externally-threaded-type electrodes of the batteries will not break through the cover, and therefore the short-circuiting of the batteries is avoided. And besides, the plurality of ribs are provided instead of increasing the wall thickness of the cover as in the conventional structure, and therefore the cover has a lightweight design, and the resin molding of the cover is easy, and the cover is produced at low costs.

[0045]

According to claim 2 of the present invention, the plurality of ribs are arranged parallel to one another, and therefore an impact is absorbed efficiently, and the transmission of the impact to the parts within the cover is suppressed more effectively.

[0046]

According to claim 3 of the present invention, an impact, applied in every direction (for example, an impact applied obliquely to the rib), can be efficiently absorbed, and the parts within the cover is more positively protected.

[0047]

According to claim 4 of the present invention, at the time of a vehicle collision, the projection on the cover abuts against the fixing member, mounted on the electrode, and is deformed, that is, bent or crushed, thereby absorbing an impact, so that the electrode is prevented from breaking through the cover. The projections are provided instead of increasing the wall thickness of the cover as in the conventional structure, and therefore the cover has a lightweight design, and the resin molding of the cover is easy, and the cover is produced at low costs. [0048]

According to claim 5 of the invention, the projections have an annular shape, and therefore the projection is spread outwardly or compressed uniformly upon application of an impact, thereby absorbing the impact more efficiently. Therefore, adverse effects on the interior of the cover are further reduced. The distal end portion of the electrode is received in the annular projection, and therefore the protection and insulation of the electrodes are enhanced both before and after a collision.

[0049]

According to claim 6 of the present invention, the gap between the projection and the fixing member is smaller than the gap between the electrode and the cover. Therefore, the projection first abuts against the fixing member to absorb an impact, so that the distal end of the electrode strikes against the cover with a weakened force, or hardly comes into contact with the cover. As a result, the electrode is positively protected, and

the electrode is positively prevented from breaking through the cover. Therefore, the short-circuiting at the time of a collision is positively prevented.

[0050]

According to claim 7 of the present invention, at the time of a vehicle collision, an impact is more positively absorbed by the synergetic effect of the ribs and the projection, and therefore the protection of the parts within the cover is achieved more positively. The ribs and the projections are formed on the cover, and therefore the cover has a lightweight design as compared with the conventional structure in which the cover has an increased wall thickness. And besides, the molding of the cover is easy, and the cost of the cover is produced at low costs.

[0051]

According to claim 8 of the invention, the ribs and the projections are disposed generally symmetrically with respect to the plane of the cover. Therefore, at the time of a collision, an impact can be positively absorbed simultaneously by the ribs and the projection, and the protection of the interior of the cover is achieved more positively.

[0052]

According to claim 9 of the present invention, the plurality of ribs are interconnected by the bulge portions, and therefore the bending strength of the ribs increases, and the ribs will not be bent, but are properly crushed at the time of a collision. Even when an impact is applied in an oblique direction, the

ribs will not be bent, but are properly compressed (crushed), and an impact in every direction can be dealt with. The bulge portion is crushed together with the ribs, and therefore the shock-absorbing force is enhanced, and a higher impact can be dealt with.

[0053]

According to claim 10 of the present invention, the bulge portions can be crushed together with the ribs to absorb the impact more effectively.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 is a partly cross-sectional, perspective view of a shock-absorbing structure of a battery cover forming a first embodiment of the present invention;

Fig. 2 is a perspective view showing a condition in which the cover has absorbed an impact;

Fig. 3 is a perspective view showing a shock-absorbing structure of a battery cover which is a modified form of the structure of Fig. 1;

Fig. 4 is an exploded, perspective view of a shock-absorbing structure of a battery cover forming a second embodiment of the present invention;

Fig. 5 is a cross-sectional view of the shock-absorbing structure of Fig. 4 in an assembled condition;

Fig. 6 is a plan view showing a condition in which a shock-absorbing projection interferes with a nut of the battery;

Fig. 7 is a cross-sectional view showing a condition in which an impact is absorbed;

Fig. 8 is a cross-sectional view showing a shock-absorbing structure of a battery cover forming a third embodiment of the present invention;

Fig. 9 is a perspective view showing a more specific form of shock-absorbing structure of the third embodiment;

Fig. 10 is a perspective view showing another more specific form of shock-absorbing structure of the third embodiment;

Fig. 11 is a perspective view showing a further more specific form of shock-absorbing structure of the third embodiment;

Fig. 12 is an exploded, perspective view showing a battery-connecting plate, including a conventional cover and a conventional casing, and a battery block;

Fig. 13 is an exploded, perspective view showing the other examples of a conventional cover and a conventional casing; and

Fig. 14 is a cross-sectional view of the structure shown in Fig. 13 in an assembled condition, and illustrates a problem thereby.

[Description of Reference numerals]

1,3,8,18,25,38,50: cover

2,4,5,19,31,43,52: rib

9,56: case

10: electrode

11: nut (fixing member)

14,20: projection

5 21,33,44,53: bulge portion

S1,S2: gap